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TABLE OF CONTENTS

July 24, 1919

THE MASSACHUSETTS MEDICAL SOCIETY.

PAPERS AND DISCUSSIONS OF THE ANNUAL MEETING OF THE SOCIETY, JUNE 3, 1919.

WHAT GENERAL SURGERY HAS GAINED FROM THE WAR. *By Hugh Cabot, C.M.G., M.D., F.A.C.S.*, Boston. 79

EMPYEMA. *By Homer Gage, M.D.*, Worcester, Mass. 84

EMPYEMA IN CHILDREN, WITH SPECIAL REFERENCE TO DIAGNOSIS. *By Frank Spooner Churchill, M.D.*, Boston. 87

DISCUSSION OF PAPERS BY DRS. CABOT, GAGE, AND CHURCHILL. 90

ORIGINAL ARTICLES

DIPHTHERIA, THE UNCONTROLLED. *By Bernard W. Carey*, M.D., Boston. 92

BRONCHITIS, THE MOST SIGNIFICANT DISEASE OF THE WAR. *By George A. Soper, Ph.D.*, New York. 95

BOOK REVIEW

Diseases of the Skin. By James H. Sequeira, M.D. 98

EDITORIALS

THE PANDEMIC OF 1918. 99

PHYSICAL EXAMINATION OF THE FIRST MILLION DRAFT RECRUITS. 100

RABELAIS, A LITERARY PHYSICIAN. 101

MEDICAL NOTES. 101

CORRESPONDENCE

ARSPHENAMINE AND VASO-DILATORS—A FURTHER EXPLANATION. *H. S. Jelalian, M.D.* 106

THE POLITICAL DUTY OF PHYSICIANS. *Edwin A. Sanborn, M.D.* 106

MISCELLANY

MEMORIAL RESOLUTIONS FOR DR. SARAH A. BOND FRASIER. 106

The Massachusetts Medical Society.

PAPERS AND DISCUSSIONS OF THE ANNUAL MEETING OF THE SOCIETY, JUNE 4, 1919.

WHAT GENERAL SURGERY HAS GAINED FROM THE WAR.

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Lieutenant-Colonel, R.A.M.C.; Former Officer Commanding No. 22 General Hospital, B. E. F.

THE contributions which the war will be found to have made to general surgery center almost entirely about the management of contaminated and infected wounds. Other departments of surgery, notably orthopedic surgery, involving the question of the late results of bone injuries, are likely to be importantly affected, largely through the opportunity of working out on a large scale methods of treatment which have heretofore remained somewhat in the realm of the doubtful on account of insufficient experience. Particularly is this true of the application of bone grafts and the treatment of ununited fractures.

My own experience though large in numbers was limited to the care of casualties in the comparatively early stages. None of the British hospitals in France were in a position to keep their patients any longer than was absolutely necessary and it followed that our knowledge of end results where these were long postponed was of necessity much limited. On the other hand, a very large opportunity was given for the study of wounds at periods varying from 24 hours to several days after the occurrence of the casualty, and it is therefore possible to survey the field of acute war surgery with some prospect of accuracy of conclusion.

The great problem of this war was the management of contaminated and potentially infected wounds. The distinction between contaminated and infected is a real one upon which, in fact, turns most of the developments of war surgery. The contaminations were always potential infections and that with a great variety of organisms, some of them pathogenic, others harmless, collected from the various flora of Flanders Field. As time went on it became clear that some period, long or short, must elapse between the receipt of a wound, with its accompanying contamination, and the growth and development of bacteria to an extent properly dignified by the term infection. It is in this interval between the contamination and the development of infection that treatment can most closely approach the ideal, and

upon it attention was increasingly centered as the war went on.

You will all of you remember the more or less burning controversies of the earlier days between the various methods or schools of wound treatment, all of which turned upon the use of one antiseptic or another or one method or another of applying them. Here belong the very interesting experiments in the use of varying strengths of salt solution to which so much time and intelligence was devoted by Sir A. E. Wright. Dakin's solution, particularly in its relation to the so-called Carrel-Dakin method, has occupied a large place in the literature of the time. Then came "B. I. P." and flavine, active competitors in an already crowded field; but, like their predecessors, all of them addressed to dealing with wounds at a time when contamination had developed into infection, and all of them handicapped by the everlasting handicap which weighs down the use of all antiseptics. From time immemorial the wise and the foolish alike have sought for some substance which, brought in contact with an infected wound, shall have the power of penetrating the tissue and destroying the organisms without unfavorably affecting the tissue itself. No such substance has been obtained, and though we have learned that many antiseptics of great bactericidal power are worthless or even harmful because of the damage which they do to the tissue, we have always returned to the basic fact that the only satisfactory method of treating an infection is by preventing it. Undoubtedly "B. I. P." and flavine served a valuable purpose in this war, and it is doubtful whether under conditions of active fighting it will ever be possible to dispense with antiseptics. The great advantage which the introduction of these two antiseptics brought to the surgery of war was that it rendered transportation from forward areas to lines of communication, and ultimately to the bases, possible by checking the spread of infection and minimizing the amount of dressing necessary during this period, which may extend to several days. None of us who lived through it, will forget the relief which these two antiseptics brought over the previous methods of wet dressings, frequently changed, which, during 1916 and early 1917, were commonly miscalled Carrel's method. The frequently changed wet dressing was a practical impossibility and therefore a tragic absurdity during days of active fighting; and the attempt at its execution was often followed by a dreadful mortality whether of life or limb. The introduction of "B. I. P." and flavine enabled wounds to be dressed only at relatively long intervals varying from a few days up to a week and yet to remain in satisfactory condition. But this lengthening of the interval between dressing came about, at least in part, because of a wider acceptance of the axiom of the surgery of this war that all penetrating or so-called lodging wounds in which projectiles and contaminated clothing are retained must be widely opened and at least roughly cleaned, with the removal of foreign material, at the earliest possible moment. Upon the acceptance of this axiom turned practically the whole development of the surgery of the last year and a half of the war. Much credit should be given to Carrel for his early enunciation and persistent advocacy of the doctrine of free incision and careful mechanical cleaning. I think that on the whole the French medical service grasped this truth earlier than the British, though my contact with their work was not sufficient to enable me to express an opinion as to their practicability to carry it out.

PRIMARY AND DELAYED PRIMARY SUTURE.

The development of war surgery centered around what is now known as primary and delayed primary suture. I will not take your time by discussing the details of technic but the principles are as follows: Primary suture may be applied to any battle wound, lodging or otherwise, in which contamination has not as yet developed into full blown infection. It depends obviously upon the possibility of thoroughly exposing all portions of the wound to sight, of removing foreign bodies and foreign material and with it damaged or partly damaged tissue. It is further necessary that the space thus left should be such that it can be closed without leaving dead spaces which, where they occur, are practically certain to vitiate the result in a greater or less degree. Much discussion has centered about the length of time after wounding at which such sutures can be carried out; but as our experience increased, it became evident that elapsed hours were only relatively important and that in a proportion of cases, decreasing as time went on, such sutures could be carried out up to a period of

even two or three days. This was far more true of superficial than of deep wounds, and also of wounds in which projectiles did not remain, such as through and through wounds, grazing wounds, and wounds caused by relatively large shell fragments of low velocity.

The term delayed primary suture was given to those cases in which, partly from doubt as to the success of the cleaning process and partly from lack of time on account of pressure of work, it was not deemed safe or possible to complete the operation. Under these circumstances the wound was packed, with or without the use of some antiseptic, and the patient evacuated to lines of communication where the wound would be closed after an interval of from 24 to 72 hours.

In the early days of this work on primary suture, considerable stress was laid upon the importance of taking cultures from varying parts of the wound in the hope that it would importantly affect the treatment. In the long run I do not believe that this was the case, partly because the results of such cultures implied a large element of uncertainty and accident according to the thoroughness with which cultures were taken and the care with which their results were worked out. In war surgery, at least, all this work must be done under pressure and deals with relatively large numbers, large enough at least to swamp the bacteriological establishment of almost any field hospital under the pressure of heavy fighting. It was undoubtedly true that the inclusion in the wound of the hemolytic streptococcus was likely to be followed by a bad result, but my experience leads me to believe that the inclusion of considerable numbers of the gas bacillus group was commonly not followed by any such result. In practice, I doubt if reliance was in fact placed upon laboratory findings in the majority of cases, and in our own work we early discarded them and depended entirely upon the expert judgment of men trained in war surgery for one or two years.

It was not possible to keep accurate figures of this work over long periods of time, but I have here a few which probably represent a fair average of the development during the latter part of 1918. During a period of five days in August, 1918, four hospitals in the Camiers district received 2,008 wounded and operated upon 749, which is 37%. This figure is probably below the average which was being done at that time as I find that during the same days at No. 22 General Hospital we did 505 operations, probably about 50% of the wounded received. During a period of six weeks from the first of August to the middle of September, No. 22 General Hospital received 5,539 wounded and operated upon 2,047, 36%. This appears to show that during conditions of active fighting, even under the most severe pressure, about 35% of the wounded casualties that arrived at the evacuation hospitals on lines of communication are thought to require operation. During this same period of six weeks, 933 cases were thought appropriate for suture, primary or delayed, and of these 741 were primarily sutured. A much larger per cent. would have been treated by delayed primary suture had it not been for the impossibility of retaining them in hospital for the week or ten days which such cases require, and this does not therefore represent a satisfactory figure upon the relative frequency with which delayed primary sutures would be carried out under satisfactory conditions.

The literature of this subject has now become very voluminous, but until we get a little further away from the heat of battle and the stress of controversy no one opinion can be accepted as authoritative. Thus it has been widely held that primary suture of wounds was relatively unlikely to be successful unless undertaken within the first 24 hours. If this had proved to be true only a comparatively small number of casualties could have been thus treated as this method involves delay in evacuation from forward areas and is quite incompatible with active fighting conditions. Early in August a group of hospitals in the Camiers district demonstrated satisfactorily that cases, the majority of which were from 24 to 48 hours old, could be treated by primary suture carried out by a great variety of surgeons with at least 84% of complete successes and 91% of partial and complete successes. A further continuation of this experiment at No. 22 General Hospital showed that this was true in a series of over 700 cases, many of which were more than 48 hours old. I am therefore inclined to advise that the decision be made upon clinical evidence tending to show whether or not contamination has in fact resulted in in-

fection which has penetrated deeply into the tissue. I am certainly not prepared to accept the widely expressed view that the mere lapse of 24 hours, even in lodging wounds involving fractures, is a contra-indication to primary suture.

In order to discuss this question more intelligently, the cases should be divided into (1) cases involving only the soft parts; (2) cases involving bones but not joints; (3) cases involving joints.

(1) Obviously cases involving only soft parts are, other things being equal, more readily dealt with and likely to give better results. On this point I am able to report 479 cases with 410 (86%) complete successes, 16 (3%) partial successes (by which phrase is meant the removal of an occasional suture on account of stitch abscess, without affecting the integrity of the wound), and 53 (11%) failures. The results will, of course, vary with the depth to which the wound penetrates, and in general penetrating wounds of the buttock were best treated by the open method, as were the deeply penetrating wounds of the thigh. Complications, such as damage to the arterial supply, as in the case of the posterior tibial in the calf, would militate against the best results.

(2) It was commonly believed that compound fractures as a complication of lodging wounds could not be submitted to primary suture except in their earliest stages. That this is not invariably true, and that time ought not to be accepted as a positive contra-indication to operation, may be judged from a group of 184 cases done during August and September, with 146 (79%) successes, 11 (6%) partial successes, and 27 (15%) failures. It may properly be admitted that these cases require more skill and judgment than do the wounds of the soft parts, but it is probably not true that failure will have to be paid for at a very much higher price. The osteomyelitis, which is the most serious result of failure, does not appear to me to be importantly worse than that which almost invariably follows upon the open treatment of these wounds. The decision of this point must of course be left until the final results of these never ending cases of osteomyelitis are better known, but at the present time I think there is no evidence to show that serious acute osteomyelitis is importantly more common after failure of primary suture than after open treatment.

(3) Perhaps the most brilliant successes of primary suture are the cases involving important joints, and this has perhaps more application to the conditions of civil practice than any other of these groups. In the early part of the war, the knee joints infected by gun shot wounds were treated by incision, irrigation, and drainage, and even by laying them wide open by transverse division of the ligamentum patellae, flexing the joint to a right angle and allowing the infection to subside when an attempt was made to restore the integrity of the joint. All methods of drainage proved in the majority of cases to be more or less disastrous failures, and it was to this group of cases that primary suture was applied earlier perhaps than to any other group. It soon became an accepted doctrine that excision of the wound with removal of the foreign body, careful irrigation of the joint, and complete closure at least of the capsule was commonly followed by brilliant success. Extensive damage to the bone involving the joint or extensive damage to the cartilage always gave less satisfactory results and, even in the earliest stages and with the best technic, cases of extensive damage to the joint surfaces frequently ended in failure. Shattering injuries, whether of the condyles of the femur or the head of the tibia, came to be generally regarded as requiring either excision or amputation. On the whole, the enormous number of knee joint injuries, even after the lapse of 24 hours, gave excellent functional results if the indications for cleaning and irrigation were carefully carried out and the joint accurately closed, even though complete suture of the overlying soft parts was not done. In probably the majority of cases it was possible to completely suture the whole wound and get primary union and full motion.

Injuries to the wrist joint, which is ordinarily regarded as a difficult joint to deal with, do well under this method by the removal of all bones damaged to any appreciable extent. This might involve the removal of a portion or the whole of the carpus and might even involve the removal of the proximal end of one or more metacarpals, yet the result at the end of two or three weeks was a joint with a reasonable amount of motion and free use of the tendons. This latter was most difficult to obtain in the earlier methods of open treatment and varying degrees of claw hand commonly resulted. Per-

haps the most brilliant group of these hand injuries was the very common through and through machine-gun bullet wound of the palm, involving one or more metacarpals, commonly breaking through into the wrist joint with a varying amount of damage to tendons. Scrupulously careful cleaning of these wounds with suture of the tendons, occasionally of the nerves, and removal of bone fragments, commonly gave thoroughly useful hands, a result which could not have been obtained by open methods.

Much less satisfactory results were obtained in wounds involving the elbow, shoulder, hip, and ankle joints. This was probably due to the anatomical difficulties of thorough cleaning; and particularly in the shoulder and hip joints, really satisfactory irrigation of the joint is hardly possible. Our experience led us to expect infection of these joints with greater frequency and in the cases of the elbow, shoulder, and hip to resort to excision in a larger proportion of the doubtful cases.

CHEST SURGERY.

Undoubtedly the experiences of the war have added considerably to our knowledge of the surgery of injuries of the chest. Much greater boldness of treatment developed as time went on, and was justified by the results. In the earlier years of the war it was the general custom not to interfere with large hemothorax due to through and through wounds, on the ground that removal of the fluid was likely to be followed by fresh bleeding. Several observers have pointed out that if it was desired to avoid expansion of the lung this could be done by replacing the fluid removed, by sterilized air or oxygen, much upon the same principle as that used in the production of artificial pneumothorax for tuberculosis. In this way further bleeding could be certainly controlled, but the number of cases to which this procedure was applied probably diminished rather than increased during the latter part of the war, as evidence accumulated to show that large hemothorax, whether or not treated by aspiration, tended to result in crippling of the lung, and that opening of the chest with removal not only of the fluid but the clotted portion of the blood, gave a better late result. Suture of the lung, if bleeding appeared, and particularly the removal of indriven bone, was commonly followed by much more complete expansion of the lung and not commonly by an amount of infection and empyema that was serious. During 1918 many surgeons of all the Allied group came to believe that in penetrating wounds of the chest with retained foreign bodies these should generally be removed by free incision, cleaning of the track in the lung, removing of bone fragments, drying out of the cavity, and suture of the wound. This procedure was commonly followed by expansion of the lung to a considerable extent and also commonly by the formation of a small encapsulated empyema which could either be treated by repeated aspiration, which was more successful than would be ordinarily expected, or by reopening of the wound. These small encapsulated empyemas commonly did well, particularly with drainage, and the amount of ultimate crippling of the lung with retraction of the chest wall was much less than in those cases in which infection of the hemothorax was allowed to develop, and tying up of the lung became a serious factor in producing a large stiff-walled cavity much more comparable to the post-pneumonic empyemas of civil practice. I have had the feeling that the development of these rather radical measures in chest surgery was still in its infancy and that had the war lasted longer the number of officers who were well equipped as regards technic and experience would have increased to such an extent that the already good results would have become even better.

APPLICATION OF THESE PRINCIPLES TO CIVIL SURGERY.

It is clear that the surgery of war, at least as concerns infected wounds, can have but a limited application to the accidents of every-day life. On the other hand there are, particularly in large industrial or railroad centers, a very considerable group of cases in which the injuries do not importantly differ from the wounds of war. Thus the compound fractures with indriven bone and foreign material roughly resemble the lacerated injuries produced by high explosive shells. These can certainly be treated during the early hours after injury by the principles of thorough cleansing through free incision, with the removal of all foreign material and damaged tissue, the rectification of the bone fragments, and suture of the wound. Many damaged hands which ultimately give un-

satisfactory results will do better than in the past if these principles are applied. The penetrating wounds of the knee joint which we tended before the war to approach with fear and trembling can now certainly be dealt with boldly and with greater certainty of complete success. Crushing injuries of the chest or the less common stab wounds with division of intercostal arteries will do well when treated more radically than in the past has been the custom. There need be no hesitation about freely opening a chest full of blood in order to suture a bleeding wound of the lung or to tie a divided intercostal under a good exposure. Such cases should do even better than wounds of war since the probability of infection from without is greatly less and the surgeon may confidently rely upon his ability to drain a small empyema, should it occur, with the knowledge that the lung has expanded freely and that the final result will be a great improvement over that which will occur if large accumulations are allowed to look after themselves.

It is perhaps proper to utter a word of caution in accepting the figures which we put out from these hospitals near the fighting line. It is probably true that, even though these men are fatigued and even war-worn, they are still in better physical condition than the average civilian of the modern world; that they show a higher degree of resistance, whether to infection or to the physical insults of operative surgery. It is quite impressive to observe the extent to which these fighting youngsters can be literally smashed to pieces without destroying either their courage or their ability to resist infection. On the other hand, it should be possible to surround the problems in civil life which approach those of war with greater niceties of aseptic technic than was for us possible, and it may be that these two factors will so nearly balance each other as to give substantially symmetrical results.

EMPYEMA.

BY HOMER GAGE, M.D., WORCESTER, MASS.

The army camps have during the past two years afforded a most unusual opportunity for the observation and study of empyema, and when the experience of them all has been tabulated and carefully analyzed, as it will be, we shall have a contribution to the literature of the subject of unusual value. Even if it fails to settle some of the problems which we should like to see settled, it will furnish the largest amount of statistical material on empyema gathered under identical conditions during the same period by a large number of different observers, than has ever been made available to the profession.

There were during the mobilization two distinct groups of empyema, common to all the camps. One during the winter of 1917-18, following the epidemic of measles, and characterized by the presence of the hemolytic streptococcus; the second, in the autumn of 1918, following the epidemic of influenza, characterized by the presence of pneumococcus or streptococcus, or both. Both groups gave the impression to those who had them in charge of being quite different from the empyema which they had been in the habit of seeing in civil practice.

It is not easy to define this difference exactly, but it seemed to me that from the surgical standpoint the most striking difference was the opportunity to see the cases very early after the onset. I think in most of our metropolitan hospitals we see cases much later, when the other serious complications have been outlived and more or less resistance to the infection has been acquired. They are more like what we used to call thoroughly ripe abscesses than like acute spreading infections, and the problem as well as the prognosis is quite different. Then, too, the chronic empyemas of tubercular origin were not met with in the army hospitals.

The experience of the last four years in France and Belgium has added very much to our knowledge of chest injuries, widened very much the field of operative interference, and simplified its technique. From this experience we look forward confidently to a decided improvement in the treatment and results of thoracic injuries. It can hardly be said that our experience with empyema has given us equal confidence. There is nearly as much diversity of opinion as to the proper treatment as ever there was, and this diversity of opinion as expressed in the reports from the different camps is the strongest possible evidence that we have not yet evolved a perfectly satisfactory technique.

In a discussion of this subject before the Society at its annual meeting last year, after confessing my dissatisfaction with our results at

Camp Devens, I closed by saying,—"that in a future series I would immediately begin irrigation with Carrel-Dakin solution."

Well, I have now tried that method and am still disappointed in my results. The mortality is still too high, and the time required for convalescence seems unnecessarily long. But, after all, a careful study of unsatisfactory results is quite necessary to progress, and I am therefore disposed to present mine without apology.

The cases occurring in the early part of 1918 have been very fully studied and admirably reported by Lieutenant Horace Gray, M.C., U.S.A., in the recent numbers of the BOSTON MEDICAL AND SURGICAL JOURNAL.

Although the cases which were observed as a sequel to the epidemic of influenza have not led us to any different conclusions, it seems worth while to compare these later cases with Lieutenant Gray's in order to make the record of empyemas at Camp Devens complete. The results as a whole are neither very bad nor very good. I shall refer to the earlier group of Lieutenant Gray as Group 1 and the later cases of last fall and winter as Group 2.

The total number of cases under observation was 77 and 61—138—as indicated by the following table:

TABLE I.

	Group 1			Group 2		
	No.	Deaths	%	No.	Deaths	%
Cases operated on ..	43	9	21	45	9	20
Cases not operated on	17	8	47	11	3	27
Undiagnosed until autopsy	17	17	100	5	5	100
TOTAL	77	34	44	61	17	28

It will be observed that the mortality in the operated cases is practically the same in the two series, or about 20%. In the unoperated cases of the second group we were fortunate in having a larger percentage that improved rapidly after simple aspiration, and a smaller percentage of cases so desperately ill with general septicemia that operation seemed inadvisable.

As we were particularly fortunate in our ability to secure permission for autopsies in these cases, it is believed that the above represents a full and accurate statement of all the empyemas occurring in camp during both epidemics. The incidence of empyema in the first group was 16%, or 77 cases out of 485 pneumonias; in the second group it was 61 cases out of about 2,000—the exact number of cases has not been tabulated yet—or not far from 3%—a very marked difference.

TABLE II. TIME OF ONSET OF EMPYEMA.

	Group 1	Group 2
In 1st week	27	5
In 2nd week	19	1
In 3rd week	6	13
In 4th week	7	11
In 5th week	1	9
Beyond 6th week	0	17
TOTAL	77	56

Our first case of influenza was admitted to the hospital early in September, but the first case of empyema was not discovered until October 7. In 90% of the second group the diagnosis of empyema was not made until after the second week; while in the earlier hemolytic group 80% occurred within the first two weeks. The same contrast appears between the two groups in the cases reported from other camps and constitutes an essential difference in the character of the infection.

In one set of cases the effusion seemed to occur almost simultaneously with the signs of lung invasion, and was recognized early because we had an opportunity not often afforded in civil practice of seeing a large group from the very onset of infection.

That the more rapid development of the effusion in the first series is partly explained by the difference in the infecting agent is illustrated by the following table:

TABLE III. BACTERIOLOGY OF PLEURAL EFFUSION.

	Group 1		Group 2	
	No.	Died	No.	Died
Pneumococcus alone				
Operated cases	8	0	24	5
Non-operated cases	14	11	4	1
Streptococcus alone				
Operated cases	26	8	8	2
Non-operated cases	14	10	3	0
Pneumococcus and Streptococcus				
Operated cases	7	1	4	0
Non-operated cases	6	4	0	0
Unknown				
Operated cases	2	0	7	2
Non-operated cases	0	0	4	2
Influenza Bacilli				
Operated cases	0	0	2	0
Non-operated cases	0	0	0	0
TOTAL	77	34	56	12

It will be observed that among those cases in which the effusion appeared in the first two weeks of the disease, that is in Group 1, nearly 70% were characterized by the presence of the streptococcus, and only 28.5% by the presence of the pneumococcus; while in those in which the effusion did not appear until after the sec-

ond week, 50% were due to the pneumococcus alone, and only 26% to the streptococcus. This is, however, merely suggestive, and further study of the table shows such a variation in the severity of the same infections that we are again confronted with the unsolved problem of individual resistance and the varying virulence of the same organism under different conditions.

It will be observed that of the pneumococcus cases 50% were fatal in Group 1, and only 20% in Group 2, and nearly the same proportion prevails in the streptococcus cases. It is obvious that a more virulent type of both organisms was present in the first epidemic, and that such conflicting figures in small groups can afford no definite conclusion.

A study of the operations is more productive. Lieutenant Gray refers to the hesitancy of the surgical service to adopt early interference, and plainly indicates the feeling of the medical service that the presence of a positive culture of streptococcus, and even of pneumococcus, should determine an immediate operation.

The following table shows the difference between immediate and delayed operations:

TABLE IV. TIME OF OPERATION.

	Group 1		Group 2	
	No.	Died	No.	Died
On 1st day of empyema..	6	3	17	5
On 2nd day of empyema..	10	4	7	3
On 3rd day of empyema..	2	0	5	1
After 3rd day of empyema	25	2	16	0

The significance of this table lies in the fact that both groups show unmistakably that a heavier mortality follows hasty interference—a conclusion that was reached by the Empyema Commission at Camp Lee and seems to have been confirmed by the experience of every army camp from which reports have thus far been published. It is the one positive conclusion in regard to the treatment of empyema which can be drawn from the experience of the past year that seems likely to stand as a guide for future practice.

Preliminary aspiration, the character of the fluid, rapidity of re-accumulation, and the degree of mechanical interference with respiration are all important factors in determining the time for operation. The great thing is not to be in too much of a hurry. There are few conditions that call for the exercise of a sound surgical judgment more imperatively than this. Each individual case must be carefully watched and studied with the aid of the clinician, the laboratory, and the roentgenologist. No hard and fast rule as to the exact day can be entertained, except that the first few days after the onset of the empyema are always to be avoided.

Unfortunately there is less unanimity about the kind of operation than about the time of it. As stated in the discussion of last June, our preference is still for the minimum amount of operative interference consistent with the establishment of free drainage; and for adults we still believe that a rapid thoracotomy under local anesthesia best fulfills these indications.

For the primary operation in acute cases this should be, we think, the procedure of choice. In about 60% of the cases that recovered, this was all that was necessary. In the remaining 40% a secondary costatectomy had to be done. I believe the second operation was due more to failure of our after treatment than to the inefficiency of the first. Our chief consideration must always be the saving of life. The shortening of the period of convalescence as well as the avoidance of a secondary operation must not outweigh the risk of a higher mortality.

The question of how long a discharging thoracotomy wound shall be allowed to drain before resorting to secondary interference is important. There should be immediate alleviation of symptoms such as dyspnoea, harassing cough, and high temperature. Recurrence or persistence of these or any of them demand careful clinical and x-ray study of the chest to determine the efficiency of the drainage.

In view of the splendid results of secondary costatectomy obtained by Major Sanders, my successor at the Base Hospital, I am satisfied that we waited too long. In a large number of cases, through a long incision he has resected portions of two ribs, left the wide opening into the pleura without suture, and immediately started Carrel-Dakin irrigation. The result has been a rapidly healing wound without any mortality.

By the earlier adoption of this method I believe we might have materially shortened the period of convalescence, which averaged in our series of cases something over 90 days or 3 months. In comparison with the length of hospital residence in civil life, it must be remembered that those men had to be kept until their

wounds were entirely healed and they were able to return to barracks life. They could not be treated and dressed as out-patients or at home.

In both groups the after treatment consisted in most of the cases in simple drainage. In several of the second group the Carrel-Dakin irrigation was instituted immediately after the operation, and in a large number of instances it was tried later in the hope of speeding up convalescence. Little advantage was observed in these cases in marked contrast to the rapid improvement which has followed the use of the Carrel-Dakin method after the free opening above referred to.

The question naturally suggests itself—Is this result due to the Dakin solution or to the wide incision? I cannot but feel that the return to the good old surgical principle of large openings contributes more to success than the irrigation. The more radical operation cannot displace thoracotomy as the primary procedure on account of the danger to life, but it can with advantage be undertaken as soon as the patient's general condition will permit if the local condition is not showing satisfactory progress.

A study of the autopsy findings in the fatal cases shows that in addition to the empyema there were present in three cases, general peritonitis; in 3, purulent pericarditis; in 2, an undrained encapsulated empyema; in 2, abscess of the lung; and in all the peribronchitis and bronchiectasis characteristic of influenza.

It seemed quite obvious that the purulent pleuritis was but one of the local manifestations of a general septicemia, having its origin in the air passages. Drainage of the pleural cavity does not remove the primary focus, nor does it eliminate the infection of the pericardium or peritoneum. These are all important factors in determining the ratio of mortality as well as in controlling to a very large degree the period of convalescence, and they can be removed or modified only by a natural or an artificially induced immunity.

The purely mechanical problem of establishing efficient drainage of the pleural cavity seems capable of solution in a variety of different ways, as well as any, we think, by the method already outlined; but the extent to which complications of lung abscess, pericarditis, and peritonitis are met with in any given group of cases will always have a more important bearing on the results than the method used in removing the pus from the chest and preventing its reaccumulation. It is the unknown factor which makes a statistical study of this subject always interesting, often instructive, but usually very inaccurate and unconvincing.

EMPYEMA IN CHILDREN, WITH SPECIAL REFERENCE TO DIAGNOSIS.

BY FRANK SPOONER CHURCHILL, M.D., BOSTON.

The war has unfortunately furnished ample opportunity for the study of empyema as it occurs in adult males, with a corresponding flood of literature thereon. Naturally, these articles have not dealt with the condition in infants and children, and in civil practice there have been no special studies on the subject at those ages. Nevertheless, in response to the invitation of the committee to present a paper on empyema in children, it has seemed worth while to take up certain aspects of the disease, *viz.*, its apparent obscurity and the frequent failure to detect its presence. The paper, therefore, will deal chiefly with the diagnosis of empyema and seek to discuss some of the difficulties met in its detection. It is based on observations and clinical studies made of both children (including infants) and adults,—on infants and children at two large children's hospitals over a long period of years; on adults at two base hospitals covering a comparatively short intensive period of ten months. In each of these hospitals an epidemic of pneumonia and empyema occurred during my term of service: at Camp Stewart, Virginia, in the spring of 1918; at Camp Deven, Massachusetts, in the fall of 1918. Thus there has been excellent opportunity for a pediatrician to make a comparative study of empyema as it manifests itself at different periods of life, and perhaps to give him a clearer insight into the difficulties encountered in the detection of disease. These difficulties appear to be due to the infrequency of empyema, its insidious and gradual onset, the obscurity of its physical signs, and erroneous interpretation of the physical signs detected.

The condition is relatively infrequent in children: it developed in 5% of 824 cases of lobar pneumonia and in 1½% of 557 cases of bronchopneumonia, treated in the wards of the Children's Memorial Hospital during the last ten

years; while during the same period, only 180 cases presented themselves as such at the out-patient department, practically all undetected outside.

The onset of empyema is gradual, insidious. It is practically never primary, but almost invariably secondary, a complication, and like all complications apt to be overlooked, the mind of the clinician being centered on the original primary disease. This primary disease most commonly is pneumonia, though occasionally empyema may complicate measles, scarlet fever, tonsillitis, appendicitis, and acute arthritis. Its gradual insidious onset in pneumonia is attested by the fact that fluid is found not infrequently in the pleural cavity, before crisis:—the *"Pleuresie parapneumonique"* of the French. Thus, Jerdine, working in the wards of the Children's Memorial Hospital, found fluid in 40% of a small series of cases of pneumonia before crisis, the fluid being small in amount,—1 to 5 cc. on aspiration,—serofibrinous and sterile in character. (It was demonstrated sometimes by physical signs, sometimes by roentgen ray, and by puncture.) These conditions represent the beginnings of a possible empyema. Fortunately, few of them "ripen"; in most of them the exudate does not affect the clinical course of the disease and is presumably absorbed.

As the first step, then, in the diagnosis of empyema, the physician in attendance upon a case of pneumonia should bear constantly in mind the possibility of an empyema arising as a complication, even though this possibility become a certainty in only five out of every one hundred cases; his mind thus prepared, he will then note certain departures from the natural course of pneumonia, certain symptoms, or "danger signals" which the child hangs out when a purulent pleurisy is developing. These symptoms are general and local, with special reference to the respiratory tract. In cases ending by crisis, they may be noticed in from one or two to ten days after crisis. In cases ending by lysis, they develop imperceptibly, the slowly subsiding pneumonia apparently merging into the developing empyema. The general condition of the child is not good: he looks and appears more sick, is drowsy, begins to have the septic look of a patient harboring a pus focus. The respiratory curve stops its downward convalescent course, remains stationary, then begins to creep up, even before an increase is noted in the pulse and temperature; the breathing, however, is not labored. To be correctly interpreted in the child, both respiration and pulse should be taken while the patient is asleep. The changes thus noted suggest either a recrudescence of the pneumonia or some complication. Among the complications must be considered otitis media, empyema, pericarditis, pyelitis, meningitis, appendicitis, and arthritis.

Physical examination of the child now follows. Lack of thoroughness in this examination and inability correctly to interpret physical signs are the main reasons for failure to detect a pleuritic effusion, whether serous or purulent. The examination must be thorough, minute, and in the infant or child is often a most difficult matter. That the fluid can be discovered promptly, however, by physicians specially trained in pediatrics is evidenced by certain comparative groups of figures, *viz.*, in 43 cases of pneumonia treated in the wards of the Children's Memorial Hospital and complicated with empyema, the latter condition was detected on the average on the eighth day from the beginning of the pneumonia, whereas in the series of 180 cases of empyema detected in the out-patient department, cases in which the antecedent disease had been handled in the home, the empyema was not discovered until the 41st day, on arrival in the out-patient department. Thus the early detection of fluid in the pleural cavity is evidently dependent upon care and skill in physical examination. The examination should be made at least once daily until the source of the complicating trouble is run down. The general condition, septic look, and rapid breathing, have already been noted. Attention is directed chiefly, of course, to the chest. Here the signs dependent upon the amount and location of fluid may be at first clear, and well defined, and susceptible of but one interpretation; or obscure, difficult, and susceptible of various interpretations; later they are clear and definite. If there be a considerable amount of fluid, not encapsulated, the signs are generally unmistakable: On *inspection*, the affected side is seen to move less, is more prominent; the intercostal spaces are less distinct, even obliter

ated; if the heart beat be visible at all, the apex is seen to be displaced. On *palpation*, the vocal fremitus elicited by the speaking or crying child is diminished or absent on the abnormal side; if the chest wall be thin, râles are often felt over the other side: an accompanying bronchitis.

Auscultation is of great importance; both lungs and heart should be interrogated by this method. The respiratory murmur over the lower part of the chest, especially posteriorly, is absent, diminished, or feebly bronchial in character. It is the last-named characteristic when present which is apt to throw one off the track and point apparently to an unresolved pneumonia; but the voice sounds are diminished, there are no râles, and no friction rub.

On the part of the heart, the position and quality of the apex beat must be noted. This is a most important point and one most frequently ignored by the attending physician, be he hospital intern or the older ward-surgeon. In infants and young children, it must be remembered that the apex beat lies higher and further out than in older children and adults, and that even in these younger individuals, its position is variable. Hence, it is not sufficient to say that the apex beat is in its "normal position": the answer so often received when one inquires as to its locality. So important, indeed, is this point that interns in children's hospitals are trained to note in the records of their initial examination of all cases the location of the apex beat as to intercostal space and distance from either the median or the left mammillary line; thus there is established the position of the beat as a base in the individual child, and subsequent daily observations will show whether or not the beat is being pushed away from that base. With a considerable amount of fluid accumulating in the pleural cavity, it is pushed away. It is not, however, diminished in vigor in pleuritic effusions; the fluid does not overlie the apex; it is not "drowning" it out, as in pericardial effusions, but is pushing the whole heart to one side. Consequently the beat does not have the muffled sound noticed in the latter condition,—an observation of value in differential diagnosis. *Percussion* shows marked dulness over a large area, merging into flatness in the lower part of the chest. The dull-to-flat area is much more diffuse than in pneumonia, has not sharply defined edges, as frequently happens in the latter disease; the approximate level at which flatness begins is noted, auscultation now is practised again, and it is found that above this line respiration is bronchial and the voice sounds increased, while below it, both respiration and voice sounds are diminished or entirely absent. Percussion of the heart, if the effusion be large in amount, shows the line of dulness to be pushed to the right or left, according to the side affected. Likewise with large effusions, the abdominal viscera, liver, or spleen are apt to be pushed downward.

Such, briefly, are the signs produced by a fairly large amount of fluid in the pleural cavity. They are produced by no other condition, and if present as thus described, leave no doubt of the presence of such fluid, the character of which must then be determined by thoracic puncture. Unfortunately, however, the clinical picture is rarely so clear as I have described, especially in the early stages of empyema, with fluid small in amount or encapsulated. Here the signs may be most obscure, and this obscurity is met with more frequently in the infant and child than in the adult. Inspection and palpation of the chest may reveal nothing abnormal. Auscultation may show the heart apex not displaced, but sooner or later will reveal signs on the part of the lungs which, occurring in the wake of a pneumonia, are at least suggestive and necessitate exploratory puncture of the chest: these signs are a much diminished or faintly bronchial respiratory murmur over a limited area, generally at the base posteriorly, without râles or friction rub, a voice sound distant yet increased in intensity in comparison with the voice heard at the corresponding point on the other side. Occasionally, distinctly amphoric respiration has been heard over this limited area. I have noticed this not infrequently in children, only twice in adults. The sign, of course, suggests a pulmonary abscess, but in all the cases cited operation subsequently showed an empyema. Percussion over this limited area gives an exceedingly dull-to-flat note. These are the signs of either fluid, small in amount or encapsulated, or a pneumonia; only the exploring needle can settle the question. Given such signs late in the course of a pneumonia, the needle should always be used.

Two other aids to diagnosis of a pleuritic effusion need further mention, the one often confirmatory though not conclusive, the other final and decisive: the roentgenogram, and exploratory puncture of the chest.

The x-ray picture is of interest, often helps in locating a fluid, but is by no means conclusive, as practically the same degree and shape of shadow may be produced by a pneumonic consolidation or a pleuritic effusion; the latter, however, is generally more extensive than the former, and furthermore increases in extent from day to day,—a change not likely to take place in the late stage of a pneumonia. Hence the value of daily exposures in a suspected empyema. The two conditions, however, consolidation and effusion, have been confused with each other, as has been shown at autopsy.

Puncture of the chest with the exploring needle is the final arbiter in the question of empyema and should always be practised when fluid is suspected: in the undoubted cases, to determine the character of the fluid; in the doubtful cases, to determine the presence or absence of fluid, as well as its character. Repeated punctures may be necessary; sooner or later, they settle the question.

It is the cases with obscure physical signs which give difficulty in differential diagnosis. The conditions likely to be confused with empyema are an unresolved pneumonia, pulmonary abscess, and pericardial effusion.

The question of an unresolved pneumonia has already been partly discussed; in addition, this lesion usually gives a dull rather than flat note, louder and more distinct bronchial respiration, râles crepitant, sub-crepitant, and fine moist, and a considerable degree of bronchophony. It likewise gives a more marked leucocytosis and marked diminution of the chlorides in the urine. Pulmonary abscess is rare in children; persistent and amphoric respiration, and a tympanitic quality to the percussion note over a limited area point to this lesion. In several instances, the question was not settled until operation showed it to be an empyema. Pericardial effusion may simulate a left-sided pleuritic effusion. The area of dulness, however, is peculiar and characteristic, being pear-shaped; furthermore, the heart sounds are muffled and indistinct. The x-ray is of value in detecting this condition.

I am under obligation to Drs. John L. Morse and James S. Stone for access to the records of the Boston Children's Hospital, and to Miss B. M. Henderson, superintendent of the Children's Memorial Hospital (Chicago), for preparation of statistics.

SUMMARY.

Empyema in children is relatively infrequent, developing in only about 5% of cases of lobar pneumonia.

It is gradual in onset. In all cases of pneumonia, the possibility of its development should be borne in mind and the primary, original disease carefully studied.

Its early diagnosis with fluid small in amount is often difficult: late diagnosis with fluid considerable in amount is easy.

The diagnosis in infants and children is more difficult than in adults.

Exact examination of the chest, performed daily, is often necessary to detect the condition.

A displaced apex-beat is an important diagnostic sign.

In all cases of pneumonia where fluid in the pleural cavity is suspected, the exploring needle should be used, and if necessary, repeatedly.

DISCUSSION.

DR. LINCOLN DAVIS, Boston: As Dr. Gage said, the results of the surgical treatment of empyema depend so largely on the nature and extent of the infection that I think it is very difficult to compare statistics in different epidemics and in different localities.

I have had a very small experience with empyema as compared with Dr. Gage, but I did, in the winter of 1917-1918, see a number of cases from negro labor battalions which came into Base Hospital No. 6 at Bordeaux. These troops were employed as stevedores on the docks at Bordeaux. They were mostly Alabama and Southern negroes and seemed to have no resistance to the French climate. At any rate they came in with pneumonias in great numbers and quite a percentage of them developed infections of the serous cavities, which to me were a revelation. There would be a purulent infection of both pleural cavities and pericardium, and in many cases a peritonitis as well. The futility of draining one pleural cavity in such cases can well be imagined. I think in those rapidly fulminating cases surgery seems almost hopeless. Certainly in such cases one would feel that it was wise, as Dr. Gage said, to delay and not to operate during

the fulminating stage, but to tide over with tapping until the process localized itself, if possible; and if it does not localize, there will be a natural selection of cases which will improve the operative mortality at any rate.

Now there are just a few points which I want to speak of. With the exception of that class of fulminating cases, I feel that early operation is indicated. I mean by "early" as soon as frank pus has appeared in the pleural cavity, and before tough adhesions have formed. In adult cases I feel that resection of a rib is indicated under local anesthesia; and if care is taken, I feel that this operation can be done without any pain or shock. I have seen very sick men operated in this way under local anesthesia, without any shock and without any pain, and I am sure it can be done painlessly though it takes longer. Then, of course, getting your drainage at the bottom of the cavity is extremely important. Now for a great many years it has been considered a desideratum to get an air-tight suction drainage of the chest, and a great many ingenious devices have been brought forward which have more or less secured this result.

It has been my privilege to see a great deal of the Italian military surgery, and in Italy they are very conservative as regards wounds of the lungs and chest, and as Dr. Cabot mentioned in his paper, they employ artificial pneumothorax almost entirely in their treatment of war wounds of the lungs. Of course, we are not discussing that now, we are discussing empyema: but I had the privilege of working in an American Field Hospital alongside of an Italian Field Hospital which treated only wounds of the lungs, in the Eleventh Italian Army Corps, and they had there 150 lung wounds which I had opportunity to follow. Those were all treated with artificial pneumothorax. In the cases in which empyema developed, Major Morelli had a very ingenious method of treatment. He made a thoracotomy, resecting a rib, and then he inserted into the wound a drainage tube which is surrounded by a dumb-bell shaped rubber bag, and when that is passed into the wound the rubber bag is inflated with air with a syringe, so that it fills the wound and makes really an air-tight closure of the wound. The tube and bag are held in place by a sort of metallic spider which is held by an adhesive plaster (illustrating). I have seen a great many of these in use and they are air-tight. Suction drainage is obtained by connecting the tube with a series of bottles, one bottle for irrigation of the pleural cavity, and two bottles at different levels which create a vacuum in the pleural cavity by the force of gravity. These bottles are connected with a water manometer so that you can see whether there is positive or negative pressure in the chest. In wounds of the lung Morelli maintains positive pressure in the chest to keep the lung collapsed and to prevent the wound from reopening, and he gets perfect drainage with a positive pressure in the pleural cavity. When he thinks the wound of the lung is healed, he gradually lowers the pressure by reversing the position of the bottles until he gets a negative pressure in the pleural cavity and then allows the lung to expand. This apparatus is very simple, reminding me the moment I saw it of the Hagner bag which was devised for the arrest of hemorrhage after prostatectomy; it is on the same principle, and I think it is a practical and ingenious method of getting an air-tight closure of a wound in the chest wall.

Dr. Wyman Whittemore, Boston: I am also very much interested in a closed air-tight suction apparatus. This is based on five general principles. First, early operation. Perhaps "early" is a wrong word to use, but when the aspirated fluid is turbid with 60% or more of polymorphonuclear leucocytes and the organism causing the empyema, then I believe in operating. Instead of finding a definite walled off cavity with the lung partially collapsed, one finds the lung compressed, and this lung will rapidly expand when the fluid is let out, provided no air is allowed to enter into the pleural cavity. Second, the necessity of allowing the fluid to escape slowly. In a large empyema, if the fluid is allowed to escape rapidly, I believe there is great danger of collapse of the patient and even sudden death. Third, sterilization of the pleural cavity by Dakin's solution. Fourth, suction of the pleural cavity. Fifth, prevention of a considerable pneumothorax.

In cases in which the technique has been carefully carried out, when they are sterile, the x-ray has failed to show any pneumothorax at all in many cases, and in others only a small one between the diaphragm and the costal border.

I do not wish to take time to go into technique except to say that the operation can always be done under local anesthesia. There is no shock to it and no pain when one is familiar with the steps. I have had 70 cases operated on in this way, and this series is made up of the same kinds of empyemas as everyone else has had. I have lost four cases,—a mortality of between 5% and 6%. There is no question that the patients that receive the best, intelligent after-care are the ones who get well quickest.

There may be some who are skeptical as to the efficacy of this method, and to them I would say that although this method has not cured every case, yet it is a distinct contribution to make towards ultimate recovery, as it will often tide a patient over his extreme septic condition, and later on any operation that is necessary can be done.

DR. ERNEST A. CODMAN, Boston: This whole meeting has been extremely interesting to me because I have had the opportunity to see some of the results of the cases about which Dr. Cabot, Dr. Cushing, and Dr. Gage have been talking. Although I have held a commission for only ten months, I saw at Camp Taylor in Kentucky the results of about $^1/_{125}$ of all the American wounded as they passed through my surgical service. Perhaps 30 to 50 per cent. of these cases still needed treatment by secondary operation or dressings. Of course, Dr. Cabot and Dr. Cushing saw at the front open wounds, but necessarily they could not see how the wounds came out, and I think $^1/_{125}$ would show a pretty fair average of the whole. The majority of the cases which came through this hospital evidently had not healed by first intention. Whatever the Carrel-Dakin or other treatments did at the front, they did not, as a rule, produce the scars characteristic of first intention. There were enormous scars of all sorts which showed septic healing, or were still unhealed: but it was marvellous to see how good the results were on the whole. I was perfectly astonished to see the extent of the masses of muscle and tendon that had been taken away, and yet observe that the patients retained the function of the limbs. The surgery must have been good at the front to produce such results.

As far as the neurological cases go, there were cases where apparently the whole side of the arm or leg was gone, nerves and all, and yet the function of the nerves remained. Some of them must have been cases which they treated over there, as Dr. Cushing said, by making immediate suture of the nerve and placing it in the little muscle that was left. So that saving the nerves and tucking them away in the masses of muscles must have done the work, and the cases were splendid on the whole.

We saw a great deal more than $^1/_{125}$ of the peripheral nerve cases. I also had the opportunity at Fort Sheridan to see more than 300 such cases all gathered together in three wards, under Dr. Dean Lewis. The striking thing about these cases was, that the unassisted process of nature restored many of them while they were waiting for transfer to the nerve hospitals. Altogether I was impressed by the tremendous recuperative power of these young men. There was a tendency of nature to repair of which I had not dreamed, in seeing the average case at home of what we call civilian surgery.

Now as to empyema—at Camp Taylor there was probably more empyema than at most of the other camps. We came to the same general conclusion which Dr. Gage has expressed; that is, the idea of postponing operation until the crisis of the septicemic infection and pneumonia was passed. Dr. Gage's experience here at Camp Devens was similar in many ways, as shown by the articles which have been written by the medical men at both camps; if you compare them, they are parallel to a great extent. But there is one thing on which we differed. At Camp Taylor we found that a closed drainage, a valvular drainage, introduced so that no air got in, was more effective than an open wound treated with Dakin's solution. Dr. Whittemore has practically the same idea, and I think we may say that there is one thing the war has taught us in regard to empyema in general and that is that open drainage permitting immediate collapse of the lung has gone forever. In the future we are not going to do the old open empyema operation.

If any of you go to Atlantic City to the American Medical Association meeting, there will be on exhibition this little tube which was used at Camp Zachary Taylor and which is a practical thing that any surgeon can make out of the material in his own operating bag, and yet it will remain air-tight and do the work, with less mortality, less pain, less ward attendance, and less nursing care than the old operation.

Original Articles.

DIPHTHERIA, THE UNCONTROLLED.*

BY BERNARD W. CAREY, M.D., BOSTON,
Epidemiologist, Massachusetts State Department of Health.

IN choosing "Diphtheria, the Uncontrolled" for a title for this paper, it was not intended to belittle the results which had been obtained in past years, but rather to show that with more intensive effort a further diminution both in the incidence and mortality rates can well be effected.

It cannot be denied that much progress has been made in the control and prevention of diphtheria outbreaks, but with an average of 6,500, or more, cases being reported yearly, with approximately a 10% fatality, we cannot in truth say that we are progressing with endemic diphtheria.

Save in that period immediately following the introduction of antitoxin, there has been no marked interruption in the incidence or mortality of the disease. During the pre-antitoxin days, the average fatality percentage was about

* Read at the meeting of the Massachusetts Association of Boards of Health, April 24, 1919.

28, while in the next 20 years, from 1895-1915, we see an average of 11.5%, and for the next four years the average is little less.

Because of this stability of both mortality and fatality percentages for the past 17 years, the department investigated 1000 deaths which occurred from diphtheria in this state hoping to ascertain what factors might be present and common to all of these deaths, to fix a theoretical responsibility, and to plan, as far as possible, for their prevention in the future.

These statistics furnished much food for thought and some of our findings were truly startling. Some of the more unsuspected findings were that 31.5% of these deaths occurred in individuals who have been sick one week or more without medical attention; 11.8% occurred in individuals who were moribund at the time of the doctor's first visit; 7.6% occurred in individuals in whom the condition was unrecognized until it was too late for the antitoxin to be efficacious, and 65% of these deaths occurred in children who were 5 years or under.

The source of infection was given as unknown in nearly 90% of these deaths and the form of the disease, in order of frequency, was larngeal, pharyngeal, and nasal.

These findings can only permit the conclusions that the warnings issued by you for prevention of this infection have not made the impression that they should have and that unless some special attempt is made to awaken responsibility in people for the care and well being of those entrusted to them the story of yesterday will be repeated tomorrow.

From these investigated deaths, it appears that more attention must be paid to this group of individuals who fall within a pre-school age group, and intensive effort made to bring both to the profession and to the laity a more complete knowledge of the prevention and control of diphtheria.

I feel that we cannot be accused of allowing our wishes to run away with our judgment when we state that the time will come when the Schick reaction, with its more frequent and intelligent use, will place a large percentage of the non-immune under our care for immunization, and if the statistics of the New York City Department of Health are correct, this means that our prevention will be in direct proportion to the efforts which we expend. With 60% of the children of the pre-school age, that is under 6 years, needing immunization, which is available for them, is there not a chance for preventive work which will be really worth while?

The work done by New York has clearly demonstrated the value and safety of immunization by this toxin antitoxin mixture. Dr. Park gives statistics of over 4,000 children, 1,000 of whom were about one week old, who have been immunized with this mixture, and no case of diphtheria has developed up to date among those so immunized.

It may be that it is not wholly appreciated just how much responsibility for this continued high incidence of diphtheria lies with the boards of health of the cities, yet statistics taken from the Census Bureau show that over 80% of diphtheria deaths occurred in cities of over 10,000.

Viewed from this angle, the problem is placed at the door of the large boards of health; for, together with the largest percentage of cases and deaths, they also have or ought to have the necessary personnel and equipment for the prevention and control of the condition. Every city of this class has school physicians, school nurses, laboratory facilities, stations for the distribution of antitoxin, and the necessary regulations to enforce, by law if need be, quarantine and isolation.

What manner of excuse can be offered to explain our seeming apathy when asked by one who knows that all the necessary agents for the eradication of diphtheria are available, "Why do you have the same fatality percentage year after year?" What can the physician offer to the man who knows that diphtheria is curable, if treated early and with sufficient dosage of antitoxin, when he has had opportunity for the use of all of these by having been called upon the first day of the child's illness and has not made use of them. It appears that such a question would cause much consternation to the man who still persists in diagnosing diphtheria by odor, or by the appearance of membrane.

In the near future the time honored "waiting for a report from the laboratory" will not absolve from blame the doctor who has been negligent; for the dictum offered by the public health workers that a throat needing a culture for diagnosis should have antitoxin administered at the time of taking the culture is fast spreading to the laity, and they will soon learn to expect

such procedure from the physician to whom they entrusted their welfare.

Lest these observations might be taken by some to be criticisms, and if so taken should fall into that, the most harmful of criticisms, namely, destructive, I hasten to offer the plan that has been adopted by the State Department to effect a diminution of this disease.

I wish to offer for comparison these two facts: 1st, that for the prevention and control of diphtheria all necessary agents are at hand; 2nd, that, notwithstanding the accuracy of this statement, diphtheria is endemic in our state, possessing a fairly even death rate year after year.

As was earlier stated, ignorance as to the possibility of a sore throat being diphtheria, and the resulting delay in calling a physician, appears to be the largest single factor in our deaths. Our first hope for success, therefore, must lie in the application of special educational procedures to this problem, which will bring this knowledge of the possibility of a sore throat being diphtheria and of the necessity of calling the doctor early into the homes of those people who need it most.

To accomplish this, a special bulletin was prepared for distribution among school children, telling in plain, non-technical language a few diphtheria truths. It is hoped that they will carry this bulletin home to their mothers; and because it is brought home from school by their children it is believed that it will receive special consideration. Articles were prepared for newspapers again calling to the attention of our people some diphtheria facts, mainly, the necessity of calling the physician early in sore throat, and the value of antitoxin, both as a therapeutic agent and as a prophylactic agent for those who have already been exposed.

Nursing agencies, Parent-Teachers' Associations, and Women's Clubs have been circularized with letters from the office asking that they help augment the work the local board of health is doing by spreading the information that sore throats must not be neglected and that the possibility of their being diphtheria must be ruled out by proper cultural procedure.

With this augmentation there should appear some improvement in the early diagnosis of diphtheria and our percentage of unrecognized cases should become greatly reduced. Should it become as evident to the laity as it is to us that the mortality of diphtheria is almost in direct proportion to the delay in calling a physician and the administration of sufficient antitoxin, there surely will be a greater attempt to fulfill this requirement for a speedy recovery from diphtheria; when they know that practically all who receive antitoxin within the first 24 hours of onset recover, 95% on the second day of onset, 87.5% on the third, 78% on the fourth, 61% on the fifth, and less than 50% on the sixth day, their sense of responsibility will be more keen with resulting activity.

The dosage of antitoxin has been much discussed and without doubt will always vary; however, with a total of 27,000 units distributed by the department for each case reported, it appears that ample dosage is being used in most instances, together with sufficient antitoxin for immunization. There are two facts which everybody admits: that to have this medication effective, it must be given early and it must be given in sufficient dosage; to this we add the suggestion that in all those cases which are seen late in the disease you will not forget to mention that antitoxin may be given intravenously without harm and occasionally with most marked results.

The usual epidemiological procedures for controlling diphtheria are too well known to need discussion, and save for the later work done with the Schick test and the toxin antitoxin mixture for immunization, there is scarcely anything to offer. Culturing of schools has long produced good results and where completely carried out with re-culturing, when necessary, gives us a real method of control. In some instances, however, it has been noticed, the culturing stopped with the inmates of a certain school room; neighborhood contacts playmates, and visitors to the homes of those ill have not been done. Might it not be that there would be a greater chance of infection among those who come into close contact playing at games, than in those whose chance for contact infection would lie in sitting in the same room at school? This is not intended as a criticism of school culturing, but rather to urge a combination of culturing for both school and neighborhood, thus culminating a possible unknown or undetected source of infection. Does not the fact that 65% of our deaths are in pre-school age groups point to the necessity of such a procedure? It is our belief that here lies one of the greatest factors for the continued high morbidity and that with the in-

creased activity of your agents you will surely obtain results toward the desired end.

One other suggestion: the local boards of health, in the large majority of instances, receive notification that a culture is positive and they in turn notify the physician. It seems as if here is a chance, at very little expense of time or money, to suggest, and, if need be, send to the doctor the antitoxin necessary not only for the treatment of the patient but also for the immunization of all contacts.

Actual experience has shown that in some instances the doctor had an insufficient amount of antitoxin for the patient and contacts, so used that which he had for the treatment of the patient, leaving immunization until the next day. Would it not be possible, as a routine procedure, to telephone to the doctor, telling the positive culture and at the same time asking how much antitoxin he will need for the patient, and how much for the immunization of contacts so that, if need be, you might send to him at once?

If such procedure were followed, you will have done two things at least: you will have reminded him that such a procedure of immunizing contacts is a good one; you can tactfully suggest dosage, if it is thought advisable, so that you may be sure the necessary amount will be given; and, finally, you may rest in the consciousness of having done your full duty both to your city and to the people.

BRONCHITIS, THE MOST SIGNIFICANT DISEASE OF THE WAR.

By George A. Soper, Ph.D., New York,

Major, Sanitary Corps, U. S. A.

Bronchitis is the most significant disease which has occurred in the army in the war, not omitting influenza. It is significant, first, on its own account; second, because of its connection with other respiratory diseases, and third, for the reason that it provides means for the spread of infections which, although not strictly respiratory, are believed to be transmitted in the respiratory manner.

Bronchitis was the most prevalent disease of the war. Not only was it associated with the exanthemata, but it occurred as a separate and independent infection. In fact, the occurrence of bronchitis was well nigh universal in the army and navy camps during much of the year 1917-1918. Within about ten days after their arrival, newcomers were usually attacked, their symptoms often being pronounced from the start. In the barracks, mess halls, lecture rooms, and places of amusement, and on the drill field, coughing was often continuous. This was especially so during November, December, and January.

What passed as bronchitis was often really pneumonia. Outside of the hospitals the bronchitis was not always diagnosed correctly, especially in its early stages. Many cases were called bronchitis from their symptoms alone, but a far greater number of genuine cases of bronchitis passed merely as "colds." Of the total number of cases which occurred in the army it is believed that relatively few went to the hospital. In numerous instances pneumonia followed bronchitis.

The bronchitis which occurred in the army and to which reference is particularly made in this brief paper possessed the following clinical features as observed by the medical staff of a large general hospital.

It was an acute infectious inflammation affecting in rapid succession downward the nasopharynx, larynx, trachea, and first and second divisions, usually both sides, of the bronchial mucosa. The symptoms were coryza, rigors, hoarseness, soreness of throat, weakness, oppression, muscular soreness, and slight fever (100-101). In severe cases the temperature might be to 103 with correspondingly rapid pulse, substernal soreness, and tightness of the chest.

The cough was at first dry and unproductive. It frequently occurred in paroxysms, causing muscular pain and soreness along the costal margins at the attachment of the diaphragm. On about the third or fourth day, the cough loosened and expectoration appeared. It was at first scanty and mucous; later abundant and mucopurulent. Upon palpation and percussion only negative results were obtained. On auscultation, sibilant and sonorous râles could be noted, except when resolution began, when fine and course mucous râles were to be heard. The breath sounds were somewhat harsh.

A positive diagnosis of bronchitis was impossible unless harshness and breath sounds, sibilant râles and sonorous râles were audible, or in the stage of resolution, fine and coarse mucous râles were to be heard.

When associated with another disease, resolution in the average case was complete at best within a week. The attack often continued for many weeks and occasionally lasted for months. It was a common saying among the soldiers that the "bronchial cold," which attacked them soon after their enlistment, remained with them as long as they stayed in camp. It rarely disappeared entirely. The characteristic hard, explosive cough remained long after all other symptoms had gone. During an acute period, it not uncommonly unfitted a man for duty. There are but few soldiers whose efficiency has not been impaired by it. Except during the period of the influenza pandemic, nearly all the bronchial pneumonias began with symptoms of bronchitis.

When intercurrent with measles, scarlet fever or other infectious diseases, the bronchitis often led to fatal consequences. Statistics are not available upon this point, but there seems reason to believe that a great deal of the bronchial pneumonia which followed measles might have been traced to bronchitis, antedating the measles attack.

There is a great amount of difference in the statistics of fatal bronchitis in the different cities of the United States without there being any evident and sufficient explanation of it. There are no reliable statistics of cases. Some persons hold the opinion that the so-called bronchitis deaths are really due to pneumonia and that it is a difference in the custom of reporting rather than a difference in the occurrence, which makes one city record about twenty-five deaths from bronchitis a year while a neighboring city records about seventy.

Bronchitis is reported as a frequent cause of death in civil life in the United States; but it is seriously doubted by many whether death really occurs as the direct result of this disease. Bronchitis may be the beginning, or the most prominent condition, but pneumonia is probably the usual termination. Rarely has bronchitis been reported as a cause of death in the army.

According to the U. S. Census Bureau, bronchitis caused 11,587 deaths in the registration area in 1916, and stood thirteenth in the entire list of diseases arranged in their order of importance as causes of death. The average annual number of deaths in the registration area for the period 1901-1910 was 12,136. The latest statistics covering bronchitis in the army indicate that there were four deaths in the year 1917.*

Bronchitis is always a common disease in armies, often going by the name of "barrack cough." Little attention is ordinarily paid to it—it is generally looked upon as inevitable. It occurs all the year round with somewhat increased prevalence in the winter. The usual fluctuations are much less pronounced than those of influenza and less than those of pneumonia. Its seriousness as a fore-runner of pneumonia is seldom fully realized.

The prevalence of bronchitis appears to have been due to a number of circumstances. It was not generally dealt with as infectious. Generally it was attributed largely, if not wholly, to the soldier's own fault. Unnecessary exposure, wet feet, lack of attention to proper clothing, carelessness as to the action of the bowels, and sudden cooling after overheating were believed to be the principal contributory causes.

Laboratory findings have not agreed that any particular micro-organism has been to blame. Many organisms commonly found in the nose and throat of healthy persons and sometimes with more or less good evidence associated with disease, have been isolated from bronchitis patients. It is not impossible that, like the common cold and pneumonia, bronchitis may have many microbic causes.

Fortunately it is not indispensable that a causative agent should be discovered in order to arrive at an opinion as to the epidemiological significance of bronchitis. Contributory causes appear to be quite as instrumental in producing some of the respiratory diseases as the infective agents themselves. To prevent these contributory causes from operating would be to get the the disease under control.

Whether bronchitis renders a person especially susceptible to another disease is a question of much interest. Obviously it leads to pneumonia and pleurisy and empyema. Like pneumonia, one attack does not protect against others, but on the contrary, predisposes its victims to subsequent attacks. Some people have an attack each winter.

Chronic bronchitis may exist for a life time. Often it almost disappears only to reappear again and again with marked severity. The reappearances are generally supposed to be con-

* Annual Report of the Surgeon-General of the Army, for 1917, page 613.

nected with particular states of the atmosphere and to the conditions which, when a person is not susceptible to bronchitis, might produce a common cold. Cold, damp weather, universally conceded to be an aggravating factor in all throat affections, is unfavorable to bronchitis susceptibles. Cold, damp seasons and cold, damp climates have more than the ordinary amount of bronchitis connected with them.

Dust in excess is harmful. By many it is believed to be a sufficiently common cause of bronchial irritations to account for the excessive prevalence of the bronchitis which sometimes occurs in dusty localities. It would seem that the injury done to the mucous membranes depended as much upon the quality as the quantity of the dust. Sharp, siliceous dusts are the worst, and soft, argilaceous dusts the least harmful. In many of the American camps there was a great deal of dust during the period of mobilization. Efforts were made to prevent it in the barracks by oiling the floors and outside by oiling and watering the roads. These procedures mitigated, but did not overcome, the trouble.

Bronchitis greatly increases the danger to be apprehended from carriers of respiratory infections. A meningitis carrier may be relatively harmless so long as he is in good health, for the germs which he harbors are then fairly well locked up in his nose and throat. But when he experiences an attack of bronchitis he coughs a great deal, and at each paroxysm unconsciously seeks to shoot the germs from his nose and throat into the atmosphere.

Drastic measures have been taken to guard against infection resulting from talking and sneezing; but in so far as these procedures limit the freedom of action of the individual and depend upon scientific exactness in attention to detail, they have not proved effective. The use of the mask may be taken as an illustration. No better protection against infection has been devised and none better is to be desired than the mask. It is capable of protecting the person who wears it from infection from others and is also able to protect others from infection by the wearer. Its efficacy has been abundantly proved. The usefulness of a mask, however, depends not upon its being merely a mask but upon the perfection with which it is constructed and worn. When attention is not given to the details of thickness and closeness and cleanness which are necessary, the mask may become an actual source of danger. Attention to the details necessary is not possible with the wearers not particularly instructed and supervised. Examination of a large number of masks used in the army and in civil life during the influenza pandemic showed that most of them were worse than useless. It would be quite impracticable to insist that every person who experienced an attack of bronchitis or was in danger of proximity with affected persons should wear a mask continually. Nurses should wear them, as should physicians who are in attendance. Carriers and suspects should be masked when there is any possibility that they may convey infection to others. This does not mean that the masks should be worn continually. Continuous masking is believed by the writer to be impracticable.

To gain control of epidemic bronchitis after it has once gained headway is undoubtedly an extremely difficult undertaking. As with all infections, it is much less difficult to prevent it. In order to prevent bronchitis the conditions which lead to it must be controlled. The early cases must be detected. The cases when found must be isolated from all persons who are in good health. Of great importance is insistence upon the principle that the infectious material should not be carelessly allowed to become scattered but should be disposed of in a suitable and predetermined manner. Promiscuous spitting, coughing and sneezing must be given up. There must be a campaign of education to teach people how to protect themselves and one another.

Bronchitis is essentially a crowd disease, in the sense that it occurs when people are crowded, and shows a preference for persons who are not accustomed to crowds. Countrymen going to cities are especially susceptible. Probably no other disease has so certain a relation to crowding as does bronchitis. There is a general agreement that those who live in the open are relatively free from it and persons who have become accustomed to the conditions of city life are not especially susceptible. It is evidently the transition from the isolated to the crowded conditions of living which is dangerous. This is hardly the place to attempt to explain the relative immunity which city people enjoy toward respiratory infections, but it may be said that the theory of acquired immunity through repeated exposure to small doses of the virus appears, in the light of present evidence, to have much to recommend it.

In the American army much attention was given during the war to the crowding of barracks, and steps were taken to prevent it, but the system of sleeping—sometimes 120 men in a single room—had defects which were too deeply seated to be wholly removed. The barrack room was too large to be managed to good advantage.

In future wars the unit of space for barracks for green troops in a temperate climate should not be larger than sufficient for a squad of eight if the mechanical details for this form of construction can be satisfactorily worked out. The idea of head and foot sleeping and the scheme of suspending papers and other screens between bunks were at best only temporary makeshifts. It is a point worthy of consideration that there was much less sickness in the camps composed of tents than in those which were provided with wooden barracks, in spite of the difficulty of heating and ventilating the tents in cold weather.

It is generally assumed that the respiratory diseases were transmitted chiefly in the sleeping quarters of soldiers. There is little evidence to support this belief. Crowding is a constant feature of the soldier's life outside of his barracks as well as in them. The places which he frequents for pleasure and instruction and to make small purchases are all crowded. His mess hall and latrine afford facilities for the transmission of respiratory infections. On his days and nights off he usually visits some city or town where he is crowded as closely as he is in the camp or cantonment where he belongs. The gathering of people together is a natural and pleasantly exciting experience, when the crowding is not compulsory, and it is not to be denied that most soldiers enjoy it.

The extent of the crowding outside of the barracks and the length of time during which this crowding occurs will be described here on account of the light which it throws on the opportunities for infection which the crowding habits of the men permit. The following data, derived from a careful study of a camp, are believed to be representative.

There were four moving picture theatres with a total seating capacity of 9,389. These theatres were open from 4 o'clock in the afternoon to 9 o'clock at night. There were four performances daily. The average attendance was 3,114, which is about one-third of the capacity, but this by no means gives a correct idea of the close bodily association of those who composed the audience. The intensity of the crowding was nearly the same, regardless of the number of persons present, for the seats were taken in a compact mass, the audience not being scattered evenly through the hall. On entering and leaving the building, the personal contact was very close. The seats were 17 inches wide and there was an allowance of 28 inches per person, center to center. Briefly, about 3,110 men spent one and a half hours per day in the moving picture houses, sitting with mouths 17 inches apart in one direction and 28 inches apart in the other.

The post exchanges and Y.M.C.A. buildings, especially the latter, afforded no less remarkable examples of crowding than the moving picture establishments. Occasionally an auditorium such at the Y.M.C.A. building became densely packed for a long period of time, as for example, when an organization was detailed to attend a lecture. On such occasions each man might have but 3.12 square feet of floor space and 38.76 cubic feet of air space. In the barracks the allowance was 45 square feet and 500 cubic feet, respectively.

Dense crowding occurs in civil life, but with a certain marked difference. So large a part of the population of a given place is not so frequently crowded and the crowding is not so long continued on a given occasion. The soldier knows no greater crowding than that which occurs in street cars and subway trains; clothed human bodies cannot be packed more closely. But only one, or a few, members of a family are so exposed; the rest escape.

Book Reviews.

Diseases of the Skin. By JAMES H. SEQUEIRA, M. D. Philadelphia: P. Blakiston's Son & Co. 1919.

The third edition of Sequeira's work has appeared. The second edition was exhausted soon after it was published. The author refers to the limited amount of research work accomplished of late, owing to abnormal conditions, but finds a good deal to add, especially with regard to parasitic affections. Although new plates and figures in the text have been added, the book has not been increased in size. The new illustrations maintain the high standard of excellence of the old ones.

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THE PANDEMIC OF 1918.

"THE Lessons of the Pandemic" is the subject of a recent article in *Science* by Major George A. Soper, Sanitary Corps, U. S. A., which is of special interest in connection with the paper on bronchitis by the same author in this issue of the JOURNAL.

In expressing his views upon this important subject, the author says the whole world stood aghast at the mystery which surrounded the influenza pandemic in 1918 and that the measures which were taken for its control were really only based on theory. Because, at the beginning of its onset, it stimulated the common cold, it was impossible to adopt means of immediate isolation.

Major Soper believes that three difficulties stand in the way of prevention. First, public indifference. People who suffer from common colds do not realize the dangerous phases which may develop from such infections, and often not until very alarming symptoms have appeared does the patient consent to submit himself to definite treatment. Before this happens, however, he had very likely infected other persons.

Second, influenza is a specific infection classed, like diphtheria, measles, and scarlet fever, with respiratory diseases; but unlike the latter, the waste products of influenza cannot be adequately dealt with. Unconsciously the waste products of influenza are projected from the nose and throat through the air, and consequently the entire environment of the affected person becomes contaminated. But, because isolation is not feasible in every case where early symptoms are not merely those of a common cold, preventive measures are difficult to carry out.

Third, the period of incubation is so varied, sometimes being as short as one or two days, that it is possible to transmit the disease from one person to another before the patient himself realizes that he has been attacked. There must also be taken into consideration the likelihood of healthy persons harboring the germ. Although these obstacles may appear at first almost insurmountable, we have only to remember the progress which has been made in the control of typhoid fever, yellow fever, etc., and to look forward to the same successful combating of influenza epidemics. Public health officers, skilled bacteriologists, pathologists, clinicians who have had ideal opportunities for studying the disease, all are now at work upon their reports of the recent epidemic. And when these have been gathered together, when statistics as to age, sex, race, conditions, etc., have been tabulated and studied, much will have been accomplished toward viewing the situation from a wider perspective. Close range attack and its terrible suddenness have hampered the most careful attempt at study. Now, when it can be viewed from so many angles, a good deal may be expected in clearing up the mystery. If influenza is not entirely absent during the intervals of epidemic, so much the better for observation. Opinion is divided on this subject. Some argue that the recent pandemic was the result of a particularly virulent type of the common infection; and in almost every country the consensus of opinion is that isolation, though difficult, is the only way to exclude the disease from a community.

Many people are prone to believe that only

an atmospheric or terrestrial condition can produce a phenomenon of such world-wide prevalence. In 1889-90 it was believed by some that world conditions were responsible for that particular outbreak, and today there are people who think that it was due to the weather conditions during the winter of 1917-18. Others believe that the war was responsible, and still others say that it was spontaneously developed in many places at the same time. All these suppositions, unfortunately, seldom stand the test of scientific analysis. It is now believed, with the weight of evidence in agreement, that the immediate cause of the pandemic of 1918 was an infective virus which passed from person to person until it had spread over the entire world. The disease travelled at about the same rate at which people travel from point to point. So far the virus is believed to be an hypothetical one, and its mode of entrance, its leave-taking and period of transmission are still in question. Whether or not the disease is always with us, nobody can answer, but it would seem that it is not unlikely, for a virus which had existed somewhere among persons who had become immune to it could be introduced among strangers to it and attain enormous proportions.

However this may be, the pandemic has shown how quickly infections can travel, how easily they can gain entrance to the nose and mouth, and to what a high degree preventive measures should be carried out. Sir Arthur Newsholme, Medical Officer of Health to the Local Government Board of England, said that until the common respiratory infections are studied and controlled, it will be impossible to understand and manage influenza.

Nobody can answer the question, "Will there be another visitation?" Influenza commonly sweeps in more than one wave. If it is probable that this will be the case, then the great lesson of the pandemic has been to call attention to the prevalence of respiratory disease in ordinary times, the indifference with which we view them, and our inability to cope with them. They must be controlled by administrative procedures and by exercise of appropriate measures of self-protection. Much has been written on the subject of general health and protection, but Major Soper believes that the most essential things to remember are embodied in the following rules prepared last autumn and recommended by the Surgeon General of the Army, published by the order of the Secretary of War, to be given all possible publicity:

1. Avoid needless crowding—influenza is a crowd disease.
2. Smother your coughs and sneezes—others do not want germs which you throw away.
3. Your nose, not your mouth, was made to breathe through—get the habit.
4. Remember the three C's—a clean mouth, clean skin, and clean clothes.
5. Try to keep cool when you walk and warm when you ride and sleep.
6. Open your windows—always at home at night; at the office when practicable.
7. Food will win the war if you give it a chance—help by choosing and chewing your food well.
8. Your fate may be in your own hands—wash your hands before eating.
9. Don't let the waste products of digestion accumulate—drink a glass or two of water on getting up.
10. Don't use a napkin, towel, spoon, fork, glass, or cup which has been used by another person and not washed.
11. Avoid tight clothes, tight shoes, tight gloves—seek to make nature your ally, not your prisoner.
12. When the air is pure breathe all of it you can—breathe deeply.

PHYSICAL EXAMINATION OF THE FIRST MILLION DRAFT RECRUITS.

THE initial selective draft for 1917 presented an opportunity to study the physical constitution of the people of the United States. There were measured and examined physically about 2,510,000 men, of whom 730,000, or 29.1 per cent., were rejected because of physical disability. Between December 15, 1917, and September 11, 1918, over three million men were examined. After July, 1917, recruits were accepted in three groups: the first selected for general military service: the second, for limited or special service; and the third, for service after remediable treatment.

The percentage of rejections at mobilization camps shows a great fluctuation at the different camps; but in spite of the variation in standards of the physical examining boards, it is pos-

sible to show that the incidence of particular defects and diseases in different sections of the country is very different. It has been estimated from fairly complete returns from local boards, mobilization camps, and disability discharges, that during the first four months of mobilization about one-third of the men who were physically examined were rejected on physical grounds, and that during the following eight months about one-fourth of such men were rejected. The Provost Marshal's figures indicate that about twenty-two per cent. of the rejections were caused by some mechanical defect in the organism; fifteen per cent. were rejected because of imperfections of the sense organs, and about thirteen per cent. for defects in the cardio-vascular system. About twelve per cent. were rejected on account of nervous and mental troubles, in part due to abnormal thyroid secretions. Approximately ten per cent. were rejected on account of tuberculosis and severe cases of venereal diseases. About 8½ per cent. were rejected because of developmental defects in physique, about 6 per cent. for trouble in skin and teeth, and about 13½ per cent. for other defects. The rejections at camps following the physical examination of the first million men reveal a different order,—imperfection in the sense organs being the principal defects, mechanical defects taking second place, followed by circulatory defects and diseases, tuberculosis and venereal diseases, skin and teeth, nervous and mental troubles, and developmental defects.

In this report, Bulletin No. 11, a comparison is made between the defects found among men coming from rural and from urban communities, and in detail from four large cities,—New York, Chicago, Philadelphia, and Boston.

RABELAIS, A LITERARY PHYSICIAN.

IT is seldom that the medical profession can claim among its ranks a physician whose literary attainments have equalled those of Rabelais, the monk. In a recent issue of the *New York Medical Journal* there has appeared an interesting account of the life, interests, and achievement of this man.

Little is known about the birth, parentage, and early education of François Rabelais, except that he was born in Chinon, in Touraine, about the year 1490. He was probably brought up in a monastery, becoming first a Franciscan monk, then a Benedictine monk, and later, a secular priest.

It was probably about the year 1530 that Rabelais began the study of medicine at the University of Montpellier. In 1532, he moved to Lyons. At about this time, he published *Gargantua and Pantagruel.* During his stay at Lyons, Rabelais was engaged to take charge of the hospital patients at a salary of forty pounds *tournois* a year. He merits the distinction of being the first hospital intern whose name has been handed down to posterity. He became physician to the embassy at Rome in 1534, and in 1539 entered the service of Guillaume du Bellay Langey. During 1546 and part of the following year, he became town physician at Metz in Lorraine. In 1547, he went to Rome, where it is thought that he died in 1553.

The writings of François Rabelais reflect his interest in the medical profession, and give evidence of medical erudition far in advance of his time. His works display a wide knowledge of anatomy and of many diseases. His writings are not well known in English speaking countries. *Gargantua and Pantagruel*, his most famous work, is archaic in language and displays the unbridled license characteristic of the sixteenth century. Perhaps the only literary physician who can be compared to Rabelais is Oliver Goldsmith, and his only equal in satirical literature was Swift.

Rabelais excelled in his profession, and far surpassed the physicians of his day in medical lore. He seems to have been successful in his methods of treatment, and gave freely of his knowledge. The profession may justly be proud to claim among its members François Rabelais, perhaps the greatest of literary physicians.

MEDICAL NOTES.

GRAND CENTRAL PALACE.—On September 30, 1919, the Grand Central Palace, New York, which has been used as an army base hospital since last September, will be returned to its owners.

FORDHAM MEDICAL SCHOOL.—The medical school at Fordham University, New York, has been closed, because of lack of funds to carry on the work of the institution.

HONOR FOR AMERICAN NURSES.—On June 5, King Alexander of Greece conferred the Medal of Military Merit on nine American Red Cross nurses for their work in fighting the typhus epidemic in Macedonia.

INFLUENZA IN BATABANOS.—It has been reported that in May, 1917, over one year before the recent epidemic of influenza, there was an epidemic of disease in Batabanos which was at the time believed to be dengue. A few cases of bronchopneumonia and of meningitis, which occurred at the same time, were not associated with the epidemic. In August, 1918, there developed a similar epidemic, which was called by some dengue and by others grippe. This lasted until November and attacked in a mild form two thousand out of six thousand inhabitants. During the month of November, the disease became malignant, often causing a robust man to be killed within a few hours by pulmonary edema and cardiac collapse. There appears to have been a similarity between the two epidemics; both appeared in the summer months, and the absence of rash seems to exclude dengue. It is possible that mild episodes like those in Batabanos may in reality be true influenza in a latent form.

VALUE OF BACTERIAL VACCINES.—An article in a recent Public Health Report describes the common sources of error in determining the prophylactic or curative value of bacterial vaccines against infection. It is stated that the evidence advanced in support of certain preparations has been very striking, but that the data on which it is based is sometimes of little value. It is pointed out that there are three chief sources of error. In the first place, statistics relating to the use of vaccine in an institution, or in a group outside an institution, sometimes appear to be convincing, but lose their significance when it is learned upon closer examination that a large proportion of the personnel involved has developed the disease before the vaccinations had been done. A second cause of error is to vaccinate all persons in a group, and to interpret the failure of the disease to appear or to spread as evidence of protection; for other unvaccinated groups may have shown a similar immunity. A third mistake is in drawing conclusions from too meagre data. Probably the only way to secure acceptable evidence of the value of bacterial vaccine is by the vaccination of only a certain number of the individuals in a large group, in which the age, sex, and conditions of exposure are similar.

REPRESENTATIVE OF NURSING PROFESSION AT CANNES CONFERENCE.—Miss Julia C. Stimson, chief nurse of the American Expeditionary Forces in France and formerly head of the American Red Cross Nursing Staff in Europe, is the one graduate nurse from the United States selected to serve as a delegate to the International Red Cross Conference in France. Recently, Washington University, St. Louis, conferred the degree of Master of Arts upon her in recognition of her services overseas.

Miss Stimson is the daughter of the Rev. and Mrs. Henry A. Stimson of New York. She was graduated from Vassar in 1901, intending at the time to study medicine. Later she decided to take up nursing and in 1904 entered the New York Hospital Training School for Nurses. A few years after being graduated she became superintendent of the Harlem Hospital, New York City, which post she left to take charge of the nursing and social service at Washington University, St. Louis. Later she acted as superintendent of nurses and head of the training school for nurses at Barnes Hospital, Washington, D. C., which position she held until she joined an American hospital unit and sailed for Europe in May, 1917. She served in Great Britain ten months and was transferred to the service of the American Red Cross in April, 1918.

DECORATION OF AMERICAN NURSE BY THE FRENCH GOVERNMENT.—Miss Margaret Mahoney of New York has been awarded the highest honor of the French Red Cross and has been decorated with the *Medaille de Reconaissance de France* in recognition of her services to the French wounded. Miss Mahoney is an American girl of Irish birth. At the outbreak of the war she was living in Paris, and joined the French Red Cross, with which she served as a nurse until America entered the war. Later she joined the American Red Cross.

Emotion As An Element in Military Unfitness.—In an address before the American Psychopathological Association at Atlantic City on June 18, 1919, Dr. Tom A. Williams is reported to have expressed the belief that emotional strain is not generally an important factor of nervous break-down in war. He cited statistics which showed that of 1,240 cases of functional disorder, only 70 passed as emotional, and that even when asthenia was included in the statistics, only 13 per cent. of the patients could be included. He believes that the great proportion of the cases are hysterical rather than emotional, and that the patient's condition can be readily changed by appropriate psychological management.

Home Service Department of the Red Cross.—At a conference held in Atlantic City from May 26 to June 5, plans were outlined for the future activity of the Department of Home Service of the American Red Cross. When its workers are no longer needed among the families of soldiers and sailors, it is believed that there will still be a field of usefulness in general family social work in places where this service is not provided by other agencies. The information service, which has proved to be helpful during the war, may be continued to advantage; its basis would be a handbook including a summary of the laws which social workers should know, a social service directory, and a section dealing with such matters as immigration and naturalization laws. A third field of usefulness for the Home Service will be in meeting the needs of communities in questions of community health and sanitation.

American Medical Association.—The following report of the publications of the American Medical Association has been published in a recent issue of *Science:*

The increase in subscriptions of the *Journal* of the association for the year 1918 was small—229 all told—but this, under the circumstances, must be regarded as satisfactory. The weekly circulation during the first four months of the current year was greater than that in any previous four months, averaging over 70,000. The foreign circulation was also steadily increasing. The advertising standard of the Journal had been maintained, or, if anything, censorship had been more rigid. The wisdom of establishing the Coöperative Medical Advertising Bureau became more evident each year. This bureau had demonstrated that it was possible to secure for the state journals a fair amount of advertising of which the profession need not be ashamed. The bureau began this year with twenty-six state journals; the only state journal not represented was that of Illinois. The *Archives of Internal Medicine* had been conducted at a loss, while the *American Journal of Diseases of Children* showed a small profit. The Spanish edition of the *Journal* was now issued on the first and fifteenth of each month and contained practically all the scientific material in the regular edition; but matter that was ephemeral or of local interest was not included. The subscriptions were coming in rapidly and at present it had a circulation of 1,400. In response to a petition signed by a large number of leading neurologists and psychiatrists, the *Archives of Neurology and Psychiatry* had been established. It was published on the same terms as the *Archives of Internal Medicine.* This journal might already be regarded as a success. It was of the highest order, a credit to American medicine, and to the association. At a meeting held recently in Atlantic City, it was emphasized that the association was not publishing these journals for financial gain; its sole object was to advance scientific medicine and to benefit the American medical profession. The board of trustees was of the opinion that the association should publish more of these special journals if, and when, there was a call for them. Both the American Medical Directory and the quarterly Cumulative Medical Index showed the effects of the war and had been published at a considerable loss. The house of delegates approved a motion providing that the publication of a *Journal of Surgery* be considered and also the publication of a *Journal of Medicine* for lay readers, if the house found such a procedure advisable.

National Tuberculosis Association.—At the annual meeting of the National Tuberculosis Association held at Atlantic City on June 14, the necessity for adequate tuberculosis work was emphasized. Dr. David R. Lyman, president of the Association, is reported to have remarked that one of the greatest victories of the war was the fact that the government and the people of the United States had been awakened to the dangers of chronic as well as acute infectious diseases. He expressed the belief that a division of tuberculosis would soon be organized as a part of the United States Public Health Service, as a result of the information revealed by draft board records.

Dr. Charles J. Hatfield, it is reported, pointed out that although tuberculosis causes 150,000 deaths annually in this country, the burden of the fight against the disease is being borne by

voluntary associations, whose work is handicapped by inadequate laws.

Dr. James H. Pershing, in commenting on indigent migratory consumptives, is reported to have attributed the spread of tuberculosis to patients who travel from one place to another in search of a climate which will cure them.

Government officials and health authorities from every state in the Union discussed plans for a new nation-wide health campaign against tuberculosis.

RED CROSS APPOINTMENTS.—Colonel Richard P. Strong, of the United States Army Medical Corps, and professor of tropical medicine at Harvard University, has been appointed acting director of the bureau of hygiene and public health of the League of Red Cross Societies. Colonel Strong has risked his life many times in South America, in China, and in the Philippines and the near East in fighting tropical diseases. Two tasks which he has accomplished during the past few years are of great importance: his campaign in Serbia during 1915 against typhus, and his research investigations in trench fever.

The Red Cross has appointed Mr. W. Frank Persons of New York, formerly director-general of the department of civilian relief of the American Red Cross, director of development of the league and acting assistant to Lieutenant-General David Henderson, director-general of the league. He will undertake to mobilize the resources of the league and to assemble an organization to supervise the campaign against typhus and other relief work in eastern Europe.

AMERICAN MEDICAL ASSOCIATION.—At the meeting of the American Medical Association, held recently in Atlantic City, the following officers were elected for the coming year:

President, Surgeon-General W. C. Braisted; First Vice-President, D. L. Edsall, Boston; Second Vice-President, Emery Marvel, Atlantic City; Third Vice-President, Eugene S. Talbot, Chicago; Fourth Vice-President, George H. Kress, Los Angeles; Secretary, Alexander R. Craig, Chicago; Treasurer, William Allen Pusey, Chicago; Speaker of House of Delegates, Hubert Work, Pueblo, Colo.; Vice-Speaker, Dwight H. Murray, Syracuse, N. Y.; Trustees, Archibald Dowling, Shreveport, La., A. R. Mitchell, Lincoln, Neb., D. C. Brown, Danbury, Conn.; Judicial Council, Ira C. Chase, Fort Worth, Texas; Council on Health and Public Instruction, Haven Emerson, New York City; Council on Medical Education, Arthur D. Bevan, Chicago; Council on Scientific Assembly, J. B. Blake, Boston.

The meeting of the Association next year will be held at New Orleans.

MEDICAL VETERANS OF THE WORLD WAR.—At a recent meeting of the American Medical Association, there was organized an association to be called the American Medical Veterans of the World War. Victor C. Vaughan, dean of the University of Michigan, was elected the first president.

BRITISH HONOR FOR MAJOR-GENERAL IRELAND.—The British Government has conferred the Cross of Companion of the Bath upon Major-General Ireland, in recognition of his services as chief surgeon of the American Expeditionary Forces and as Surgeon-General of the American Army.

APPOINTMENT OF DR. LEVERETT D. BRISTOL.—The University of Tennessee College of Medicine at Memphis has elected Dr. Leverett D. Bristol dean and professor of bacteriology and public health.

APPOINTMENT OF PROFESSOR C. R. MARSHALL.—Professor C. R. Marshall, professor of materia medica and therapeutics in the University of St. Andrews, has been appointed Regius professor of materia medica in the University of Aberdeen.

DEPARTMENT OF INDUSTRIAL MEDICINE AND PUBLIC HEALTH.—A department of industrial medicine and public health has been established in the University of Cincinnati. For the support of this department for five years, it is planned that the sum of $100,000 shall be raised by the citizens' committee on finance. The course will begin in October and will be open to graduates in medicine. Instruction will be given at the college and also at various industrial establishments.

INTERNATIONAL COÖPERATION IN MEDICINE.—Plans are being made for organizing headquarters for the American Medical Association in England. There is to be a hospital, a library, lecture theatres, demonstration rooms, and reading rooms.

BOSTON AND MASSACHUSETTS.

LAWRENCE GENERAL HOSPITAL.—Charles H. Tenney of Boston bequeathed to the Lawrence General Hospital, Lawrence, Massachusetts, $50,000.

PARKER HILL HOSPITAL.—Within a short time, the Parker Hill Hospital will be returned to the Order of Elks and patients now there will be transferred to war department hospitals. James R. Nicholson, Past Grand Exalted Ruler of the Elks, in considering the future of the hospital, is reported to have expressed the opinion that the Parker Hill Hospital should be retained for the reconstruction of industrial cripples. The hospital was erected in Boston because of the recognized standing of the orthopedic work being done in this city. It is hoped that with the coöperation of national, state, and city governments, of industrial concerns, insurance companies, and individuals, the work may be continued in the reconstruction of civilian and industrial cripples.

CONTROL OF VENEREAL DISEASE AT CONCORD REFORMATORY.—The efforts which have been made to control venereal disease at the Concord Reformatory have been reported in a recent issue of the "Commonhealth." In 1911, the first doses of salvarsan were given intramuscularly in the reformatory hospital. Since that time, every case of syphilis has been treated with the combined mercurial and salvarsan treatment. Various steps of improved technique have been introduced at the reformatory clinic; the intramuscular administration was succeeded by vein dissection, then by venipuncture with a bent needle, and later by an improved straight needle held in forceps. No severe reaction and no fatalities have occurred.

The incidence of syphilis during the past year was reported as fourteen per cent. of arrivals. Approximately one-half of the cases are not cured, but a primary case is seldom encountered. Sixty persons, out of a total of seven hundred, have been suffering from gonorrhoea at this institution.

MASSACHUSETTS GENERAL HOSPITAL.—The one hundred and fiftieth annual report, Section A, of the trustees of the Massachusetts General Hospital describes the work of the General Hospital in Boston, the McLean Hospital, and the Convalescent Hospital in Waverley for the year 1918. At the General Hospital, the term of service of surgical house pupils was reduced from fourteen to twelve months; but after the signing of the armistice, steps were taken to return to the twenty-one months' service of medical house pupils. In January, an outbreak of scarlet fever in the hospital became so serious that for nearly a month only emergency patients were admitted. The service of the hospital has been increased by the sixteen-bed ward into which the old Treadwell Library has been converted. This room has been used by sailors transferred from the Naval Hospital. During the epidemic of influenza, general surgical patients, except emergency cases, were not admitted. Over eight hundred cases of influenza were cared for. In 1918, a total number of 6,702 patients were admitted to the wards, at an average daily cost of $4.37.

The Out-Patient Department cared for 25,441 cases. X-ray cases in this department numbered 9,408. The Nursing Department has done its utmost to answer the call to train more nurses, and has kept its classes as large as facilities permitted. The Social Service Department and volunteer workers have rendered notable service throughout the year. There were admitted to Phillips House 221 medical cases, 796 surgical, and 80 obstetrical cases in 1918.

The Convalescent Hospital, which has been closed for some time for the sake of economy, was opened on October 3, to provide care for McLean Hospital doctors and nurses suffering from influenza. On October 11, the lower floor was opened for convalescent cases from the General Hospital. The Hospital was again closed on November 5.

The McLean Hospital reports the admission of 137 patients in 1918; the whole number under treatment amounted to 352, with a daily average of 208 patients. The business administration of the McLean Hospital has been separated from that of the Massachusetts General Hospital. The report of the McLean Hospital contains statistical tables concerning the mental conditions of patients and causes of death, and gives an account, also, of the war services rendered by the doctors and nurses of the hospital.

MASSACHUSETTS HOSPITAL FOR CONSUMPTIVES.—The twelfth annual report of the Massachusetts Hospital for Consumptives records the work of the North Reading, Lakeville, Westfield, and Rutland State Sanatoria during the

past year. These institutions have provided for a total of 403,375 days of treatment for 2,455 patients. The Barnstable County Sanatorium, situated at Pocasset, was opened in August, 1918, and other similar institutions will be completed as rapidly as possible. The work of the tuberculosis dispensaries which have been established throughout the State has proved to be valuable in making prompt diagnoses of early cases and also in the care of patients discharged from the State institutions. In Massachusetts, statistics show a slight increase in the incidence of tuberculosis in the civilian population during the past year.

The North Reading State Sanatorium has cared for an average number of 196.39 patients during the year; the Lakeville State Sanatorium, 260.35; the Westfield State Sanatorium, 269.09; and the Rutland State Sanatorium, 347.83.

Miscellany.

MEMORIAL RESOLUTIONS FOR DR. SARAH A. BOND FRASIER.

THE Medical Staff of the New England Hospital for Women and Children desire to express their profound regret in the death of Dr. Sarah A. Bond Frasier. Her long and faithful service on the hospital staff, her genial personality, her inspiring coöperation in the conduct of the hospital will make her loss most deeply felt. Be it therefore

Resolved, that we convey to the family our sympathy, appreciation, and sorrow, and express to the Board of Directors our sense of irreparable loss. Be it also

Resolved, that these resolutions be published in the BOSTON MEDICAL AND SURGICAL JOURNAL.

Correspondence.

ARSPHENAMINE AND VASO-DILATORS—A FURTHER EXPLANATION.

Boston, July 5, 1919.

Mr. Editor:—

Since the publication, in the JOURNAL, of my article on the above subject, some of my professional friends have asked me some questions pertaining to it which perhaps indicate lack of lucidity on my part in my original treatment of the subject. Hence this short appendix.

A young physician, of high scientific attainments and connected with one of our leading medical schools, wrote down the chemical formula of arsphenamine and added to it the formula of sodium nitrite ($Na\ No_2$) and wanted to know if there would be any chemical or pharmaceutical incompatibility in the resultant combination. I told him that Nature's natural laboratory (the human body) did not always work in accordance with our laboratory experiments. However, in order to avoid that remote contingence, we can dissolve the proper dose (one or more grains) of sodium nitrite in enough of distilled water, and administer it 15 or 30 minutes before giving the proper dose of arsphenamine. Thus the two salts will not come into physical contact in the stomach, while sodium nitrite, previously entering the blood current, will dilate the arterioles and thus facilitate wide distribution and absorption of the specific drug. This is perfectly feasible if once we adopt the sodium salt as a pilot synergist of arsphenamine.

The second question raised is concerning the physical condition (whether in powder or in solution) of arsphenamine to be given by the mouth. Now it is intravenously administered in solution once a week, on an average. Three 4½ decigrammes (5 or 7½ grains respectively) are dissolved in 250 c. c. of distilled water and injected at one sitting. Now, why cannot we dissolve the proper dose of the drug in 250 c. c. of distilled water, put it in an eight-ounce glass-stoppered bottle, and tell the patient to take one tablespoonful, t. i. d., P. C. or A. C., as the case may be determined upon by experience. *A priori*, it ought to be taken after meals, along the general principles of the exhibition of arsenic preparations, and about an hour and a half after eating, in order to make its sojourn in the stomach as short as possible. The sodium nitrite pilot synergist can be taken before meals if so preferred. The patient will have on hand two bottles of medicine—one of sodium nitrite and the other of arsphenamine. When he uses them up, he will come back to his physician for a fresh supply. Each practitioner ought to prepare his own solutions of these two salts under the strictest conditions of pharmaceutical cleanliness. I have no doubt as to the satisfaction this procedure will give both to the doctor and to his patient, avoiding laceration of the arms and occasional dangerous syncope. As sodium nitrite is soluble at the rate of one part in five parts of water, we can dissolve one ounce of it in five ounces of water and tell the patient to take five drops of it 30 minutes before he takes the parent medicine, or before each meal, as the case may be.

DR. H. S. JELALIAN.

THE POLITICAL DUTY OF PHYSICIANS.

Somerville, Mass., June 27, 1919.

Mr. Editor:—

I agree fully with Dr. Samuel B. Woodward in his article in the JOURNAL of June 26. Every registered voter, physicians included, should attend all primaries and then all elections, as their duty to the country. Physicians should not shirk these duties. They should use all their influence for the nomination and election of honest, capable men. The people should closely watch all legislation, state and national. While legislators and executives are the power *pro tem.*, the people are the source of power and should see that wire-pulling rings, mercenary tricksters, together with retro-active and unconstitutional legislation, are excluded from all legislative bodies. Members of legislative bodies are there to carry out the will of their constituents and not to encroach upon the constitutional rights of the people, not to break government contracts with the people, nor to enact retro-active legislation for salary grabbing or other unlawful purposes. The American Medical Association would do well to carry the last retro-active, contract-breaking narcotic act to the United States Supreme Court to test its constiutionality. What kind of a war could the United States carry on without the aid and coöperation of the medical profession? And it should insist upon and protect its rights against all schemers who are attempting to encroach upon them. If we have biennial elections we should have the initiative, referendum, and recall, lest some forget the wishes of their constituents, before their terms expire.

EDWIN A. SANBORN, M.D.